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ORIGINAL ARTICLE

BODY MASS INDEX, FUNCTIONAL FITNESS AND NUTRITIONAL BEHAVIOURS OF SENIOR WOMEN FROM THE KRAKÓW POPULATION

Maria Gacek[1], Agnieszka Wojtowicz[2], Grażyna Kosiba[3], Magdalena Majer[3], Joanna Gradek[4]

[1]Department of Sports Medicine and Human Nutrition, Institute of Biomedical Sciences, University of Physical Education, Kraków, Poland
[2]Department of Psychology, Institute of Social Sciences, Krakow, Poland
[3]Department of Theory and Methodology of Physical Education, Institute of Social Sciences. Kraków, Poland
[4]Department of Track-and-Field Sports, Institute of Sports Sciences, University of Physical Education in Kraków, Poland

ABSTRACT

Background. Body Mass Index (BMI) is dependent on, among others, diet and level of physical activity. Seniors are more prone to nutritional disorders than other population groups.

Objective. The aim of the study was to analyse the relationship between BMI and nutritional behaviours as well as the functional fitness level of senior women.

Materials and methods. The research was carried out among a group of 120 women aged 60-84, using the TANITA SC-330ST body composition analyser, the HOLTAIN anthropometer, the Fullerton Functional Fitness Test and the author-designed nutritional behaviour questionnaire for seniors. Statistical analyses were conducted using the IBM SPSS 21 statistical package, applying the *Kruskal-Wallis* ANOVA tests with comparisons of z tests at the significance level $p<0.05$.

Results. In terms of the relationship between BMI and functional fitness indices, it was shown that women with normal weight obtained higher results for the lower body ($p=0.043$) and upper body agility tests than obese women ($p<0.001$). Females with normal BMI also obtained higher results in the endurance test than the overweight women ($p=0.038$). In terms of the correlation between BMI and nutritional behaviours, it was demonstrated that women with a healthy body mass more often ate varied, low-volume meals than those overweight ($p=0.026$). Women with correct weight ate fish, eggs and lean meat more often than obese women ($p=0.036$). Obese women consumed 3-5 portions of fruit and vegetables less frequently during the day than women with normal body mass ($p=0.029$) and those overweight ($p=0.015$). Obese women were less likely to eat sea fish at least 1-2 times a week than overweight females ($p=0.040$) and those with normal BMI ($p<0.001$). At the same time, women with a normal BMI indicated a higher degree of performed daily physical activity than the overweight women ($p=0.028$) and those with obesity ($p=0.030$).

Conclusions. Women with normal BMI presented more rational nutrition habits and higher functional fitness than overweight and obese senior women.

Key words: *BMI, functional fitness, diet, senior women*

STRESZCZENIE

Wprowadzenie. Wskaźnik masy ciała BMI jest uzależniony m.in. od sposobu żywienia i poziomu aktywności fizycznej. Osoby starsze bardziej niż inne grupy populacyjne są narażone na zaburzenia stanu odżywienia.

Cel. Celem badań była analiza zależności pomiędzy BMI a zachowaniami żywieniowymi i sprawnością funkcjonalną kobiet w wieku senioralnym.

Materiał i metody. Badania przeprowadzono w grupie 120 kobiet w wieku 60-84 lata, z zastosowaniem analizatora składu ciała TANITA SC-330ST, antropometru HOLTAIN, testu Fullertona sprawności funkcjonalnej oraz autorskiego kwestionariusza zachowań żywieniowych dla osób starszych. Analizy statystyczne przeprowadzono za pomocą pakietu statystycznego IBM SPSS 21, z zastosowaniem testów ANOVA *Kruskala-Wallisa* wraz z porównaniami testami z na poziomie istotności $p<0,05$.

Wyniki. W zakresie związków BMI ze wskaźnikami sprawności funkcjonalnej wykazano, że kobiety z normowagą uzyskały wyższe wyniki w próbie gibkości dolnej ($p=0.043$) i górnej części ciała niż kobiety z otyłością ($p<0,001$). Kobiety z prawidłowym BMI uzyskały także wyższe wyniki w próbie wytrzymałości niż kobiety z nadwagą ($p=0,038$). W zakresie związków BMI z zachowaniami żywieniowymi wykazano, że kobiety z prawidłową masą ciała częściej spożywały urozmaicone, mało objętościowe posiłki niż kobiety z nadwagą ($p=0,026$), częściej także spożywały ryby, jaja i chude mięso niż kobiety z otyłością ($p=0,036$). Kobiety z otyłością rzadziej spożywały 3-5 porcji warzyw i owoców w ciągu

Corresponding author: Maria Gacek, University of Physical Education, Al. Jana Pawła II 78, 31-571 Kraków, Poland; Phone: +48 12 683 11 45, Fax +48 12 683 12 23, e-mail:maria.gacek@awf.krakow.pl

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dnia niż kobiety z prawidłową masą ciała (p=0,029) oraz z nadwagą (p=0,015). Rzadziej także spożywały ryby morskie przynajmniej 1-2 razy w tygodniu niż kobiety z nadwagą (p=0,040) i z prawidłowym BMI (p<0,001). Zarazem kobiety z normatywnym wskaźnikiem BMI w wyższym stopniu deklarowały codzienne podejmowanie aktywności fizycznej niż kobiety z nadwagą (p=0,028) i otyłością (p=0,030).
Wnioski. Kobiety w wieku senioralnym z prawidłowym wskaźnikiem masy ciała BMI wykazywały bardziej racjonalne zachowania żywieniowe i większą sprawność funkcjonalną niż kobiety z nadwagą i otyłością.

Słowa kluczowe: *wskaźnik BMI, sprawność funkcjonalna, sposób żywienia, kobiety w wieku senioralnym*

INTRODUCTION

Body Mass Index (BMI) is an anthropometric index of nutritional status, depending, among others, on diet and level of physical activity. Older people are more likely than other population groups to suffer from disorders of nutritional status, both in the form of low (and energy and protein malnutrition) and excessive body mass (overweight and obese), increasing health risks, including those associated with the development of metabolic process syndromes and decreasing the quality of life [2, 3, 10, 14, 15, 17, 33]. In research on the subject, the prevalence has been confirmed of low and excessive body mass in the senior population, its scale increasing with age, both in Poland [20, 33, 36] and in other countries around the world [35, 37].

A proposal to promote a healthy lifestyle for older people is the "Healthy Active Senior" programme, implemented at the University of Physical Education in Kraków. The aim of the programme is to improve health potential, including the psychophysical fitness of seniors through participation in recreational activity (health training) and lectures on modified conditions of the aging process as well as the possibility of delaying involutional changes. Other authors, including those from Spanish and Italian centres, also pointed to the need to run programmes promoting a healthy lifestyle for the senior population [22, 23].

Within the context of changes in body mass and composition, as well as the decline in physical fitness with age and the behavioural determinants of BMI, research has been undertaken to analyse the relationship between BMI, nutritional behaviours and functional fitness of senior women.

MATERIALS AND METHODS

Participants

The research was conducted in the fall of 2019 among women participating in the " Healthy Active Senior" project, implemented at the University of Physical Education in Kraków (POWR.03.01.00-00-T225/18) within the framework of the EU Operational Programme - Knowledge Education Development for 2014-2020. The study was carried out after obtaining written informed consent from the participants, done in accordance the 1964 Declaration of Helsinki.

The study comprised 120 women aged 60-84 (M=65.6; SD=4.1, Me=65). The sample was dominated by women with higher (58.3%) and secondary education (37.5%), while there were fewer women with basic vocational education (4.2%). The majority of women lived in Kraków (91.7%), less often in smaller centres. They most frequently assessed their financial situation as average (75.0%), less often as below average (12.5%) or above average (12.5%). In terms of health assessment, women declared the presence of chronic diseases, most often hypertension (33.3%), type 2 diabetes (12.5%) and osteoporosis (12.5%).

Instruments

Body mass index was assessed on the basis of body mass measurements using the TANITA SC-330ST body composition analyser and body height (using the HOLTAIN anthropometer), based on the following formula: BMI=BM (kg)/H (m^2). The BMI classification criteria, modified in relation to WHO recommendations, were adopted, analogously to those used in the NU AGE trial [24]. The categorisation of the group according to the BMI value (20.0-24.9 normal, 25.0-29.0 overweight and ≥30.0 obese) showed that in the study group, there were 38 women with normal body mass (31.7%), 50 women were overweight (41.7%) while 32 were obese (26.6%). There were no women in the group with a BMI lower than 20.0 kg/m^2. The median age of the normal weight and overweight women was 65, for obese women this totalled 66. It was found that the obese women were older than the normal weight women (p=0.036).

Physical fitness was assessed using the Senior Fitness test (Fullerton Functional Fitness Test) [31]. The test consists of 6 fitness tests that allow to indirectly assess the strength of the upper and lower body, agility, complex motor coordination, balance and aerobic endurance. Further trials of the Fullerton test include: 1) flexing the loaded arm for 30 seconds (assessment of the strength of the upper body - arm muscles, 30-Second Arm Curl), 2) reaching behind one's back, scratching one's back, the so-called Safety Pin test (assessment of mobility, flexibility of the upper body - upper limb, Back Scratch/Safety Pin), 3)

getting up from a chair within 30 seconds (evaluation of the strength of the lower body - pelvic and lower limb muscles, 30-Second Chair Stand), 4) bending the trunk forward in a seated position (assessment of flexibility, lower body flexibility, lower limb, Sit-and-Reach), 5) standing up and then walking a distance of 2.44 m (assessment of agility and dynamic balance, Timed Up-and-Go), 6) walking in place for a duration of 2 minutes (assessment of endurance and exercise tolerance, 2-Minute Step in Place)) [31].

To assess diet, the author's (*Gacek M.*) questionnaire evaluating nutritional behaviour among seniors, referring to the Polish recommendations for seniors was used (i.e. Pyramid of Healthy Nutrition and Physical Activity for the elderly, by M. Jarosz) [16]. The questionnaire is composed of 22 items regarding the degree of implementing rational eating behaviours, with a 5-point scale of responses according to *Likert* (from 1 to 5, from "definitely not", "rather not", "hard to say", "rather yes" to "definitely yes"). The questionnaire questions concerned: consumption of the recommended number of meals (5-6 and 4-5), regularity of meal consumption, daily consumption of a hot meal, drinking at least 2 litres of fluids, consumption of recommended products (vegetables and fruits, whole grains, dairy products, legumes and other protein products), preferred fats, limiting the consumption of non-recommended products (red meat and meat products, sugar, sweets and sweetened drinks, salt, alcoholic beverages), the use of spices, vitamin D supplementation, as well as individualisation of nutrition depending on health state, taking food-medication interactions into account, and engaging in regular physical activity. Based on the results of the questionnaire, the degree of implementing individual dietary recommendations and the general index of rational eating behaviours were assessed (on a scale of 1-110 points, assuming that the higher the index, the stronger the rational eating behaviour). *Cronbach's* α coefficient was determined for the discussed proprietary questionnaire and totalled 0.78, which proves sufficient internal consistency of the tool.

Statistical analyses

Statistical analyses were performed using the IBM SPSS 21 statistical package. Due to the nature of variable distribution, the median was used as a measure of the central tendency. The comparisons of functional fitness indices and nutritional behaviours in the BMI groups were carried out via the *Kruskal-Wallis* ANOVA tests with comparisons using z tests. The significance level was assumed as $p<0.05$.

RESULTS

Statistical analysis allowed to indicate that women with a differentiated Body Mass Index (BMI) obtained significantly different results for some indices of functional fitness, including the 30-Second Chair Stand ($p=0.016$), Sit-and-Reach ($p=0.029$), Back Scratch/Safety Pin ($p<0.001$) and in the 2-Minute Step in Place ($p=0.034$) (Table 1).

Comparisons between the BMI groups showed that in the 30-Second Chair Stand, overweight women obtained significantly higher scores than obese women ($p=0.014$), and in the Sit-and-Reach, the normal weight women achieved significantly higher results than women with obesity ($p=0.043$). In the so-called Back Scratch/Safety Pin trial, the women with normal weight and those overweight obtained significantly higher agility index results than those with obesity ($p<0.001$), and in the 2-Minute Step in Place attempt, the women with normal weight achieved significantly higher results than the overweight females ($p=0.038$) (Table 1).

Statistical analysis showed that women with differentiated BMI were characterised by significantly different nutritional behaviours, including the consumption of varied, freshly prepared, small-volume meals once at a time ($p=0.006$), the consumption of several (3-5) vegetable and fruit portions per day ($p=0.007$), eating fish, eggs and lean meat ($p=0.011$), sea fish ($p<0.001$), vegetable oils ($p=0.036$), using spices ($p=0.012$), vitamin D supplementation ($p=0.038$) and declared level of physical activity ($p=0.005$). Moreover, differentiation in the general index of rational eating behaviours in the BMI groups was demonstrated ($p=0.004$). Other eating behaviours were not significantly differentiated by women's BMI (Table 2).

Comparisons between the BMI groups indicated that women with a normal BMI were significantly more likely to eat varied, low-volume meals than overweight women ($p=0.026$). In terms of fruit and vegetable consumption, it was demonstrated that obese women significantly less frequently consumed 3-5 portions of these products per day than women with normal body mass ($p=0.029$) and those overweight ($p=0.015$). It was also shown that women with a healthy body mass consumed fish, eggs and lean meat more often than obese women ($p=0.036$). In terms of sea fish, it was found that obese women less frequently consumed these products at least 1-2 times a week than overweight women ($p=0.040$) and those with a normal BMI ($p<0.001$). Normal weight women significantly more often used spices than overweight women ($p=0.042$). At the same time, women with a normal BMI indicated a higher degree of performed daily physical activity than overweight ($p=0.028$)

Table 1. Body Mass Index (BMI) and indices of functional fitness among senior women

Fullerton test trials	BMI categories	N	Median	Mean rank	Z tests			*Kruskal-Wallis* - ANOVA	
					0	1	2	H (2, N=118)	*p* value
30-Second Chair Stand (repetitions)	0: norm	36	16.00	61.50	-	z=0.75; *p*=1.000	z=1.95; *p*=0.154	8.25	0.016
	1: overweight	50	15.00	67.14		-	z=2.82; *p*=0.014		
	2: obese	32	14.00	45.31			-		
30-Second Arm Curl (repetitions)	0: norm	36	18.00	56.25	-	z=1.56; *p*=0.358	z=0.75; *p*=1.000	5.87	0.053
	1: overweight	50	20.00	67.90		-	z=2.31; *p*=0.063		
	2: obese	32	17.00	50.03			-		
Sit-and-Reach (cm)	0: norm	36	10.50	71.94	-	z=2.20; *p*=0.083	z=2.43; *p*=0.046	7.09	0.029
	1: overweight	50	-0.50	55.48		-	z=0.48; *p*=1.000		
	2: obese	32	-1.50	51.78			-		
Back Scratch/ Safety Pin (cm)	0: norm	36	1.50	70.83	-	z=0.60; *p*=1.000	z=4.19; *p*<0.001	21.06	<0.001
	1: overweight	50	2.50	66.36		-	z=3.92; *p*<0.001		
	2: obese	32	-8.00	36.03			-		
Timed Up-and-Go (sec)	0: norm	36	4.59	51.53	-	z=0.95; *p*=1.00	z=2.20; =0.084	4.88	0.087
	1: overweight	50	4.76	58.66		-	z=1.44; *p*=0.453		
	2: obese	32	4.92	69.78			-		
2-Minute Step in Place (steps)	0: norm	36	116.00	71.72	-	z=2.49; *p*=0.038	z=1.93; *p*=0.162	6.74	0.034
	1: overweight	50	111.00	53.12		-	z=0.34; *p*=1.000		
	2: obese	32	111.00	55.72			-		

Table 2. Body Mass Index (BMI) and rational nutritional behaviours among senior women

Nutritional behaviours	BMI categories	n	Median	Mean rank	Z tests			*Kruskal-Wallis* - ANOVA	
					0	1	2	H (2, N=120)	*p* value
5-6 meals a day	0: norm	38	4.00	68.50	-	z=2.09; *p*=0.110	z=0.67; *p*=1.000	5.10	0.078
	1: overweight	50	2.00	52.86		-	z=1.28; *p*=0.602		
	2: obese	32	2.50	62.94			-		

Nutritional behaviours	BMI categories	n	Median	Mean rank	Z tests			*Kruskal-Wallis* - ANOVA	
					0	1	2	H (2, N=120)	*p* value
4-5 meals a day	0: norm	38	4.00	66.03	-	z=0.91; *p*=1.000	z=1.21; *p*=0.680	1.74	0.418
	1: overweight	50	4.00	59.22		-	z=0.42; *p*=1.000		
	2: obese	32	3.50	55.94			-		
Varied diet, small-volume meals	0: norm	38	4.00	73.87	-	z=2.63; *p*=0.026	z=2.32; *p*=0.061	10.19	0.006
	1: overweight	50	4.00	54.18		-	z=0.04; *p*=1.000		
	2: obese	32	4.00	54.50			-		
Min. 1 hot meal a day	0: norm	38	5.00	60.26	-	z=0.05; *p*=1.000	z=0.04; *p*=1.000	0.01	0.997
	1: overweight	50	5.00	60.64		-	z=0.01; *p*=1.000		
	2: obese	32	5.00	60.56			-		
Min. 2 litres of fluids a day	0: norm	38	4.00	68.13	-	z=1.47; *p*=0.422	z=1.36; *p*=0.518	2.89	0.235
	1: overweight	50	4.00	57.10		-	z=0.04; *p*=1.000		
	2: obese	32	3.00	56.75			-		
Fruit and vegetables: 3-5 portions a day	0: norm	38	4.00	66.08	-	z=0.06; *p*=1.000	z=2.59; *p*=0.029	9.94	0.007
	1: overweight	50	4.00	66.52		-	z=2.80; *p*=0.015		
	2: obese	32	2.00	44.47			-		
Grains, including wholemeal products every day	0: norm	38	4.00	60.84	-	z=0.32; *p*=1.000	z=0.30; *p*=1.000	0.44	0.803
	1: overweight	50	4.00	58.44		-	z=0.62; *p*=1.000		
	2: obese	32	4.00	63.31			-		
Dairy products, fermented, min. 2 portions a day	0: norm	38	4.00	67.16	-	z=1.48; *p*=0.415	z=0.91; *p*=1.000	2.45	0.294
	1: overweight	50	3.00	56.06		-	z=0.44; *p*=1.000		
	2: obese	32	4.00	59.53			-		
Fish, eggs, lean meat in the diet	0: norm	38	5.00	73.26	-	z=2.30; *p*=0.064	z=2.51; *p*=0.036	9.04	0.011
	1: overweight	50	4.00	56.04		-	z=0.47; *p*=1.000		
	2: obese	32	4.00	52.31			-		

Nutritional behaviours	BMI categories	n	Median	Mean rank	Z tests			*Kruskal-Wallis* - ANOVA	
					0	1	2	H (2, N=120)	*p* value
Sea fish min. 1-2 times a week	0: norm	38	4.00	74.00	-	z=1.62; *p*=0.313	z=3.79; *p*<0.001	15.51	<0.001
	1: overweight	50	3.00	61.84		-	z=2.47; *p*=0.040		
	2: obese	32	2.00	42.38			-		
Legumes in the diet	0: norm	38	3.00	56.84	-	z=0.96; *p*=1.000	z=0.30; *p*=1.000	1.09	0.580
	1: overweight	50	4.00	64.02		-	z=0.59; *p*=1.000		
	2: obese	32	4.00	59.34			-		
Limiting red and processed meats	0: norm	38	5.00	67.39	-	z=1.48; *p*=0.419	z=1.03; *p*=0.911	2.65	0.266
	1: overweight	50	4.00	56.34		-	z=0.31; *p*=1.000		
	2: obese	32	4.00	58.81			-		
Limiting animal fats	0: norm	38	5.00	70.71	-	z=2.03; *p*=0.126	z=1.74; *p*=0.245	5.50	0.064
	1: overweight	50	4.00	55.50		-	z=0.09; *p*=1.000		
	2: obese	32	4.00	56.19			-		
Plant oils everyday (or almost every day)	0: norm	38	5.00	69.18	-	z=1.12; *p*=0.781	z=2.32; *p*=0.060	7.31	0.036
	1: overweight	50	5.00	60.76		-	z=1.39; *p*=0.490		
	2: obese	32	4.00	49.78			-		
Limiting sugar, sweets, sweetened beverages	0: norm	38	5.00	63.66	-	z=0.17; *p*=1.000	z=1.18; *p*=0.701	2.02	0.365
	1: overweight	50	4.00	62.40		-	z=1.09; *p*=0.821		
	2: obese	32	4.00	53.78			-		
Limiting table salt	0: norm	38	4.00	62.71	-	z=0.90; *p*=1.000	z=0.27; *p*=1.000	1.83	0.400
	1: overweight	50	4.00	55.94		-	z=1.15; *p*=0.750		
	2: obese	32	4.50	65.00			-		
Using spices	0: norm	38	5.00	73.24	-	z=2.46; *p*=0.042	z=2.27; *p*=0.069	8.90	0.012
	1: overweight	50	4.00	54.82		-	z=0.07; *p*=1.000		
	2: obese	32	4.00	54.25			-		

Nutritional behaviours	BMI categories	n	Median	Mean rank	Z tests			*Kruskal-Wallis* - ANOVA	
					0	1	2	H (2, N=120)	*p* value
Avoiding alcohol	0: norm	38	4.00	59.03	-	z=0.02; *p*=1.000	z=0.69; *p*=1.000	0.75	0.686
	1: overweight	50	4.00	58.86		-	z=0.76; *p*=1.000		
	2: obese	32	4.00	64.81			-		
Vitamin D supplementation	0: norm	38	5.00	69.92	-	z=1.41; *p*=0.477	z=2.26; *p*=0.071	6.55	0.038
	1: overweight	50	5.00	59.38		-	z=1.06; *p*=0.873		
	2: obese	32	4.00	51.06			-		
Considering health state in diet planning	0: norm	38	5.00	69.89	-	z=1.88; *p*=0.178	z=1.58; *p*=0.343	4.99	0.082
	1: overweight	50	4.00	55.78		-	z=0.12; *p*=1.000		
	2: obese	32	4.00	56.72			-		
Considering interactions between food and medications	0: norm	38	4.00	56.03	-	z=0.79; *p*=1.000	z=0.90; *p*=1.000	1.13	0.569
	1: overweight	50	4.00	61.94		-	z=0.21; *p*=1.000		
	2: obese	32	4.00	63.56			-		
Physical activity every day (or almost every day) for a min. 30-45 min	0: norm	38	5.00	74.32	-	z=2.59; *p*=0.028	z=2.57; *p*=0.030	10.66	0.005
	1: overweight	50	4.00	54.90		-	z=0.26; *p*=1.000		
	2: obese	32	4.00	52.84			-		
General index of rational nutrition behaviours	0: norm	38	92.00	75.55	-	z=2.59; *p*=0.029	z=3.13; *p*=0.005	11.17	0.004
	1: overweight	50	85.50	56.16		-	z=0.86; *p*=1.00		
	2: obese	32	86.00	49.41			-		

and obese females (p=0.030). In terms of the general index regarding rational eating behaviours, women with a normative BMI obtained significantly higher results (presented more rational food choices) than the overweight (p=0.029) and obese women (p=0.005). However, no statistically significant differences were found concerning the scale of rational eating behaviours between the obese and overweight women (Table 2).

DISCUSSION

The research discussed above allowed to demonstrate a relationship between the BMI, functional fitness and nutritional behaviours of senior women from the Kraków environment, indicating lower functional fitness and less rational nutritional choices among the women with excess body mass compared to those with a normal BMI level.

In terms of the correlation between BMI and functional fitness tests, the described tendencies, indicating significantly higher results for women with a normal BMI than in overweight and obese females, particularly concerned the following tests: Sit-and-Reach and the 2-Minute Step in Place. Thus, the obtained results indicate a higher level of functional fitness in terms of agility (flexibility) of the lower body and endurance (exercise tolerance) in women

with a normal BMI than in those with a BMI above 30 kg/m^2. In addition, obese women obtained lower results for the so-called Back Scratch/Safety Pin trial than the normal and overweight women, which means the lowest result in terms of upper body agility (flexibility). Due to the fact that physical fitness is a derivative of physical activity, the obtained results suggest a higher level of physical activity in normal weight women compared to those obese. The research allowed to confirm the predictive significance of somatic (including BMI) and health indices (including lipid profile and carbohydrate metabolism) for the level of physical fitness in seniors [11].

Correlations between low physical activity and weight gain have been confirmed among women in India [1] as well as in the Czech Republic, Slovakia and Poland [25]. In turn, the positive influence of regular physical activity on the body composition and physical fitness of various population groups, including senior women, has been confirmed in research at various centres [8, 12, 13, 26, 28, 30, 39]. In these studies, a positive effect has also been demonstrated with regard to moderate and high physical activity in mitigating the effects of overweightness and obesity, which reduce quality of life among middle-aged women [18]. The positive effect of systematic physical activity on the content of adipose tissue and BMI in people aged 40-69 in Great Britain [7] and on physical fitness, health and BMI in people aged 33-76 in Germany [38] has been further confirmed.

In terms of the relationship between BMI and nutritional behaviours, the tendencies described in our research, indicating more rational dietary choices among women with a correct BMI than in overweight and obese women, particularly concerned: consuming varied, low-volume meals, eating fish, eggs and lean meat, using spices and taking up physical activity every day (physical activity is part of the Polish food pyramid for seniors). In addition, a significantly higher overall index of rational food choices was noted among women with a normative BMI compared to the above-normative BMI group. The obtained results allow to confirm the significance of limiting the caloric value of a meal, including protein products (fish, eggs and lean meat) in the diet and daily physical activity for balancing energy balance and maintaining a healthy body mass. The results indicating more frequent physical activity among women with a normal BMI are consistent with the above presented results, indicating greater functional fitness of women having a BMI within the range of 20-24.9 kg/m^2. It has also been confirmed that obese women declared lower consumption of vegetables, fruit and sea fish than those representing the norm or overweight, further indicating incorrect nutritional choices among women with the highest BMI values, limiting the supply of antioxidants, fibre and omega-3 PUFAs. This corresponds to the properties of functional dietary fibre (lower energy density, lower values of glycaemic index and load of products) and omega-3 PUFAs (lipolytic properties), which may be conducive to the normalisation of body mass [4, 34].

Similar trends have also been described by other authors. In American research, a relationship has been observed between portion size and the risk of obesity, indicating a positive relationship between BMI and portion size [21]. In studies on the relationship between BMI and the nutritional patterns of women (median BMI=26.8 kg/m^2, 43% overweight, and 24% obese), it has been shown that high consumption of carbohydrates, sweetened beverages and refined foods is associated with a higher risk of above-normative BMI (≥30.0). On the other hand, the pattern of nutrition with the dominance of vegetables and fruits was associated with lower BMI values [32]. Correlations between lower BMI and more rational food choices have also been found among educated housewives and working women from Karachi, while working women showed lower BMI and a more favourable model of nutrition [29]. A relationship between eating habits and BMI has also been confirmed among perimenopausal women in Muritius [5]. In American studies, a relationship has also been shown between the quality of diet, physical activity and body mass of adults. It was confirmed that moderate and vigorous physical activity were inversely correlated with BMI and waist circumference in almost all age groups, including women aged 50-59 [27]. A relationship between diet and physical fitness was also established in research on senior women from Brazil and Italy [9]. In Polish studies, a relationship has also been found between BMI and food preferences of women aged 23-69 from a rural environment. It was shown that the vast majority of overweight and obese women in rural areas preferred fried foods, red meat and animal fats, consuming an insufficient amount of vegetables and fruits [19]. In other Polish studies, nutritional mistakes have been shown to cause an increase in the risk of becoming overweight and obese among seniors living in social welfare and family homes [6].

The presented research allows to confirm significant correlations between Body Mass Index (BMI) and some indices of functional fitness as well as nutritional behaviour among senior women. Further research in this area could concern, *inter alia*, relationships of other anthropometric indicators of nutritional status with the analysed fitness and nutritional variables.

CONCLUSIONS

1. Significant relationships were found between BMI and some dimensions of functional fitness, with

an indication of a higher level of functional fitness among women with normal BMI values.
2. Significant relationships were found between BMI and the general rational eating behaviour index, with an indication of more rational dietary choices among women with normal BMI values.
3. BMI is significantly predictive of diet and functional fitness among senior women.

Conflict of interest
None declared.

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